

The GHG Technology Center



Performance Verification of Commercial Technologies

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Topics Addressed

- **Overview Of The GHG Technology Center**
 - EPA's ETV program
 - GHG Center's mission and technology focus areas
- **What DG Technologies Are Being Verified?**





What Is ETV?

ETV is a voluntary program that verifies the performance of innovative technologies which solve problems that threaten human health or the environment. It was created to accelerate the entrance of new technologies into the marketplace.





ETV Program Background Info

- **Began In 1995 With Technology In All Media**
 - Air, water, soil, ecosystems
- **EPA's Office Of Research & Development**
- **ETV Operating Principles**
 - Voluntary (commercial-ready technologies)
 - Credibility (independent evaluations, stakeholder driven)
 - Quality (EPA QA oversight, key values measured)
 - Fairness (available to all)
 - Transparency (test protocols & results are public)



ETV Centers and Priority Technology Areas

CENTER	PRIORITY TECHNOLOGY CATEGORIES	VERIFICATIONS
Air Pollution Control Technology (APCT) Center Research Triangle Institute Research Triangle Park, NC	Emulsified Fuels	27
	Paint Overspray Arrestors	
	Baghouse Filtration Products	
	Add-on NO _x Control Devices	
	Dust Suppression and Soil Stabilization Products	
	Wood Products	
	Mobile Source Emission Control Technologies	
	Volatile Organic Compounds (VOCs) Emission Control Technologies	
Drinking Water Systems (DWS) Center NSF International Ann Arbor, MI	Ultrafiltration Membranes (particulates/microbial)	24
	Ultraviolet Radiation (microbial inactivation)	
	Microfiltration Membranes (particulates/microbial)	
	Enhanced Coagulation-Filtration (particulates/microbial)	
	Cartridge/Bag Filter Elements (particulates/microbial)	
	Backwashable Depth Filtration (particulates/microbial)	
	Precoat DE Filtration (particulates/microbial)	
	Ozone/Advanced Oxidation (microbial inactivation)	
	On-Site Halogen Generation (microbial disinfection)	
	Nanofiltration Membranes (organics, DBP precursors)	
	Oxidation Coagulation-Filtration (arsenic)	
	Membrane Separation (arsenic)	
	Sorptive Media Technologies (arsenic)	
Greenhouse Gas Technology (GHG) Center Southern Research Institute Research Triangle Park, NC	Advanced Electricity Production Technologies	13
	Waste Management Technologies	
	Oil and Gas Production and Distribution Technologies	
	Greenhouse Gas Monitoring Technologies	
	Large Reciprocating Engines	
	Refrigeration Technologies	
	Distributed Electrical Generation	
	Combined Heat, Power, and Cooling	



What Is The GHG Center?

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION



ETV Joint Verification Statement

TECHNOLOGY TYPE:	EMISSION CONTAINMENT AND UTILIZATION SYSTEM		
APPLICATION:	SECONDARY SEALING SYSTEM FOR RECIPROCATING COMPRESSOR ROD SEALS		
TECHNOLOGY NAME:	SEAL ASSIST SYSTEM		
COMPANY:	A&A Environmental Seals, Inc.		
ADDRESS:	3213 Texas Avenue La Marque, TX 77568	Phone: (502) 634-4796	
WEB SITE:	http://www.aagroup.com/esi	Fax: (502) 637-2280	
E-MAIL:	esi.sales@aagroup.com		

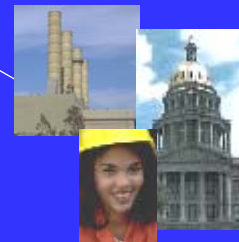
The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups which consist of buyers, vendor organizations and permittees, and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Greenhouse Gas (GHG) Technology Verification Center (the Center), one of 12 technology areas under ETV, is operated by Southern Research Institute, in cooperation with EPA's National Risk Management Research Laboratory. The Center has recently evaluated the performance of the Seal Assist System. This verification statement provides a summary of the test results for the A&A Environmental Seals, Inc. Seal Assist System (SAS).



Industry & Advocates



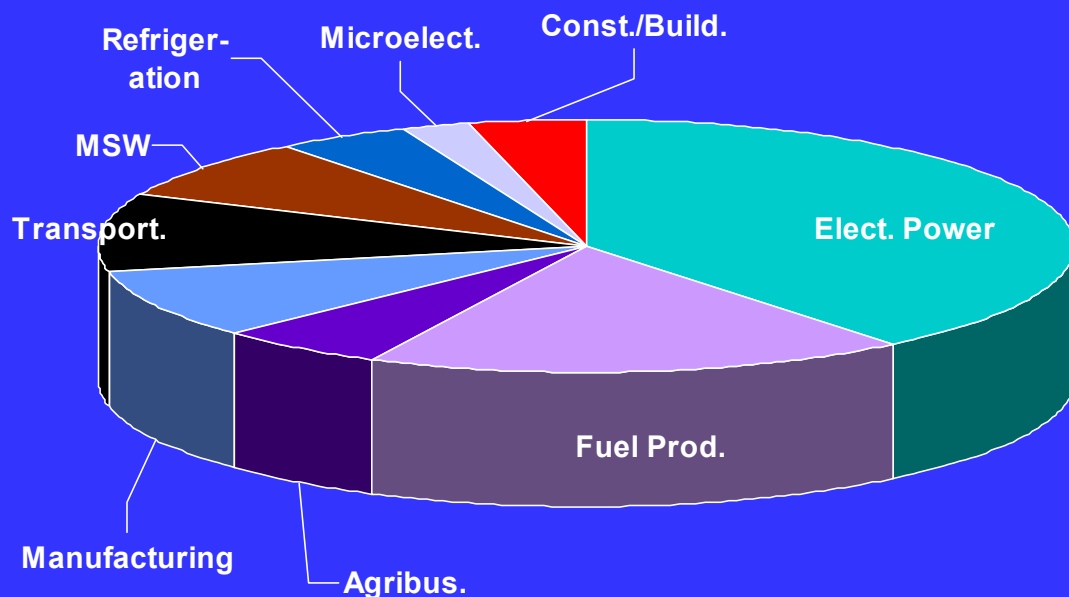
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Stakeholders Help Us Prioritize Technologies For Testing

Recent Stakeholder Meeting

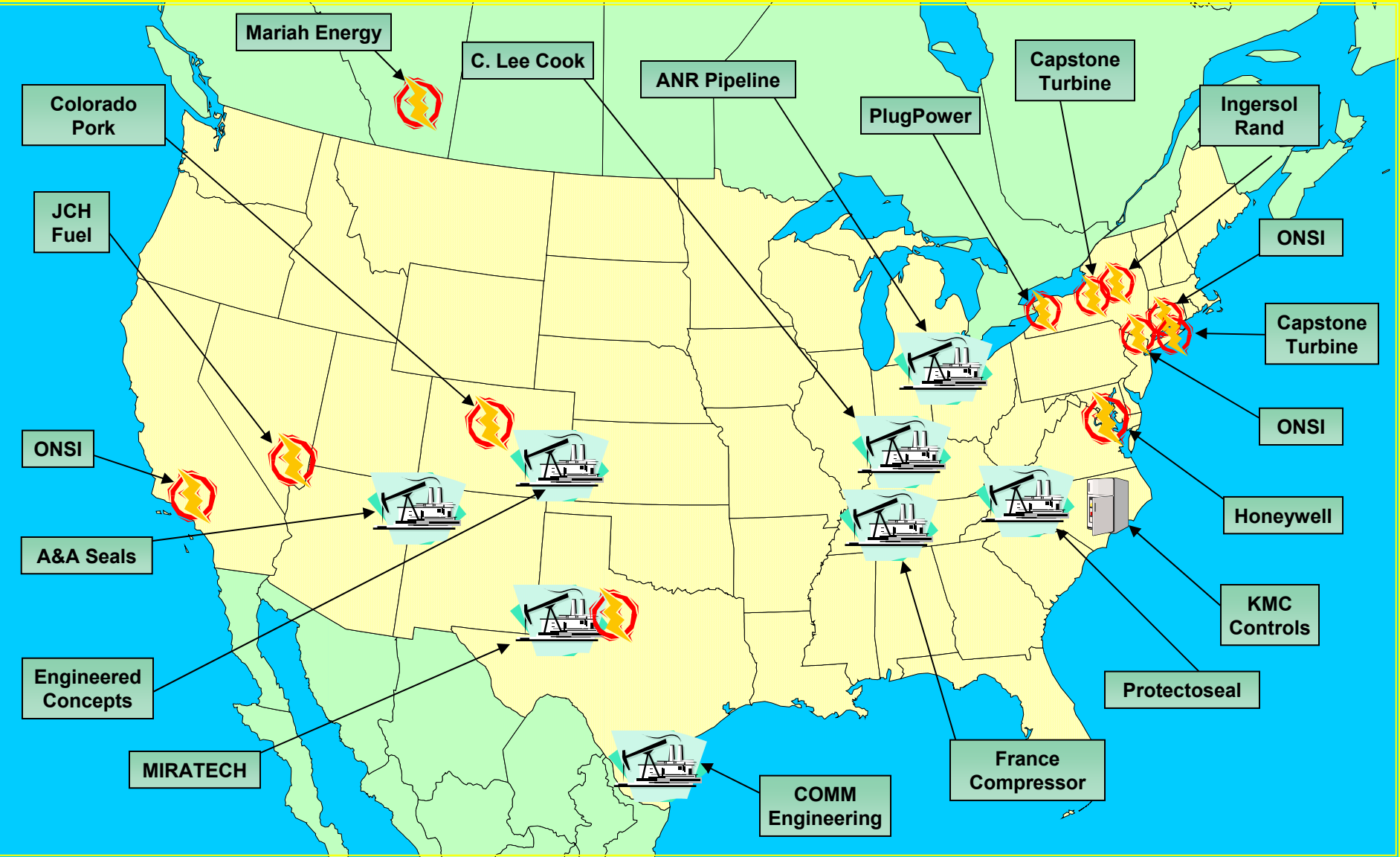
(150 Vendors, Buyers, Government Representatives)



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Current Technology Areas

<i>Technology Area</i>	<i>Types of Technology</i>	Most Active
Advanced Electricity Production	<ul style="list-style-type: none"> ▪ Distributed electrical power ▪ Biomass electrical power ▪ Combined heat and electrical power ▪ Wind and wave power 	<p>The 'Most Active' label is positioned at the top right. A long arrow points from it down the right side of the table. Four shorter arrows branch off this main arrow, pointing to specific technology types: the first points to 'Distributed electrical power', the second to 'Combined heat and electrical power', the third to 'Utilization of flare and waste gas', and the fourth to 'Technologies which improve energy efficiency and emissions'.</p>
Waste Management	<ul style="list-style-type: none"> ▪ Landfill gas use ▪ Low emission alternatives to MSW management ▪ Animal and human waste use 	
Oil and Gas Production and Distribution	<ul style="list-style-type: none"> ▪ Fugitive natural gas leak mitigation ▪ Utilization of flare and waste gas ▪ Wide range of options for the production, transmission, and distribution sectors 	
Large Engines (spark ignition and diesel)	<ul style="list-style-type: none"> ▪ Technologies which improve energy efficiency and emissions ▪ Fuel additives and retrofit devices 	
GHG Monitoring	<ul style="list-style-type: none"> ▪ Technologies applicable to sources or ambient air 	
Refrigeration	<ul style="list-style-type: none"> ▪ Technologies which reduce the release of refrigerants from commercial- and industrial-scale refrigeration equipment 	



Electricity & Engines



Oil & Gas Industries



Refrigeration



Typical Performance Parameters Verified

- **Pollutant Emission Rates**

- All important air pollutants: NO_x, CO, VOC, CO₂, CH₄, PM...
- Water and solid waste

- **Emission Capture & Reduction**

- Compare to “baseline technology”

- **Operational Variables**

- Energy conversion efficiency
- Heat and electricity production, power quality
- Availability
- Cost, economic pay-back period
- Others





DG Verifications

● Biogas

CHP → ● Sewage treatment plant

● Landfills

CHP → ● MSW handling

CHP → ● Agricultural - dairy and swine farms

● Buildings

● Commercial office

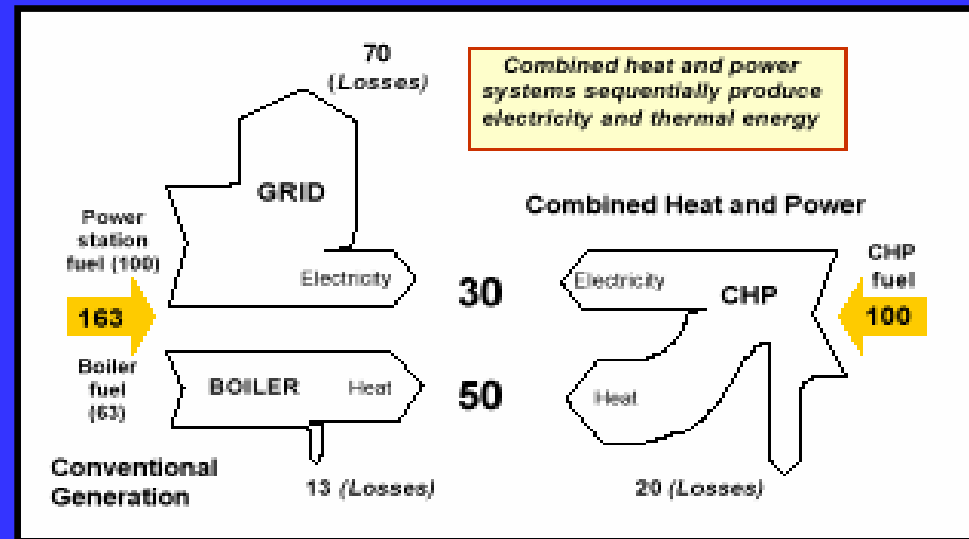
CHP → ● Condominium complex

CHP → ● Supermarket

● Private residence

CHP → ● Healthcare

Combined Heat and Power (CHP) Advantage





Mariah HeatPlus Power System Calgary, Alberta



**Mariah Energy CHP
(30 kW + Heat)**



● Good Performance Results

- Energy efficiency: 71%
- Max. emissions reduced: CO₂ 55%, NO_x 97%
- Power quality: met/exceeded IEEE standards



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Honeywell Parallon 75

College Park, MD

- **Commercial Office Building**
- **75 kW Microturbine With Natural Gas Compressor**
- **Electrical Performance At Full Load**
 - Efficiency: 23.45 %
 - 96 % Availability
- **Emissions Performance At Full Load (corrected to 15 % O₂)**
 - NO_x = 18.6 ppm
 - CO = 1.7 ppm
- **Emissions Reduced** (86 % NO_x, 27 % CO₂)





Ingersoll-Rand PowerWorks Morrisville, NY

- **Assisted Living Community Center**
- **70 kW Microturbine With Heat Recovery**
- **Heat Used To Supply Hot Water**
- **Fuel: Natural Gas**
- **2 Shaft, Industrial Grade Turbine With Integrated Recuperator**





Capstone Microturbine (60 kW)

Riverhead, NY

- **Supermarket**
- **60 kW Microturbine With Heat Recovery**
- **Desiccant Sub-Cooling For Refrigeration**
- **Thermal Recovery For Space Heating**
- **Fuel: Natural Gas**
- **Single Rooftop-Mounted Package**





Plug Power Fuel Cell *Buffalo, NY*

- **Private Residence**
- **7 kW Proton Exchange Membrane (PEM) Fuel Cell**
- **May Be Converted To A CHP Application**
- **Fuel: Natural Gas**



Fuel Processor

Fuel Cell
Stack

Power
Conditioner





Capstone Microturbine (30 kW) *Homer, NY*

- **Dairy Farm (725 head)**
- **Anaerobic Digester**
 - Minimize odors
 - Environmentally sound use of handling manure nutrients
 - >500 MWh per year biogas potential
- **Electricity From Microturbine Used On-Site**



Digester

Capstone
Microturbine

Gas
Compressor

Water
Knockout
System



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Environment & Energy Division



Martin Machinery Recip. Engine and Capstone Microturbine *Lamar, CO*

- **Swine Farm**
- **Anaerobic Digester**
 - Minimize odors
 - Comply with CO Air and Water Regulations
 - Digester feed: ~ 12,500 gallons per day
 - ~21,000 cubic feet per day biogas
- **75 kW Engine With Heat Recovery**
 - 45 - 55 kW electric power generated (~590 MWh per year)
- **30 kW Microturbine With Heat Recovery**



Heat
Recovery
Unit

Gas
Compressor

Capstone
Microturbine





ONSI Phosphoric Acid Fuel Cell Brooklyn, NY

- **Wastewater Treatment Plant**
- **Anaerobic Digester**
 - Used to reduce quantity and volatility of sludge
 - “Renewable” biogas used as fuel
- **Two 200 kW Fuel Cells With Heat Recovery**
- **Heat Used To Control Digester Temperature (~900,000 Btu/hr)**



Courtesy of UTC Fuel Cell



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SUBBOR Process

Guelph, Ontario



- **MSW Recycling And Anaerobic Digestion Process (enclosed reactors are used)**
- **Accepts Mixed MSW From Truck**
- **Produces**
 - Recycled plastic, glass, and metal
 - Bio-gas → electrical power, process heat
 - Peat for soil application ?
 - Aggregate material (landfill?)





ONSI Phosphoric Acid Fuel Cell

Groton, CT & Penrose, CA

- **Municipal Solid Waste Landfill**
- **200 kW Fuel Cell**
- **Power Output**
 - Penrose Landfill: 140 kW (44 % CH₄, LHV 446 Btu/scf)
 - Groton Landfill: 165 kW (57 % CH₄, LHV 581 Btu/scf)
- **96 % Availability**
- **Emissions (corrected to 15 % O₂)**
 - NO_x = 0.12 ppm
 - SO₂ = non-detectable
 - CO = 0.77 ppm





Summary

● ETV Program

- Voluntary program, started in 1995
- Guided by technology stakeholders
- Verified 164 technologies in all media

● GHG Center

- Partnership with SRI, EPA, industry, advocates, states
- Verified 14 technologies
- Current technology areas →
- Seeking state partners....
- Web sites: sri-rtp.com or epa.gov/etv

Technology Area

Advanced Electricity Production

Waste Management

Oil and Gas Production and Distribution

Large Engines (spark ignition and diesel)

GHG Monitoring

Refrigeration



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